An observation-based correction for aerosol effects on NO_2 retrievals using the Absorbing Aerosol Index

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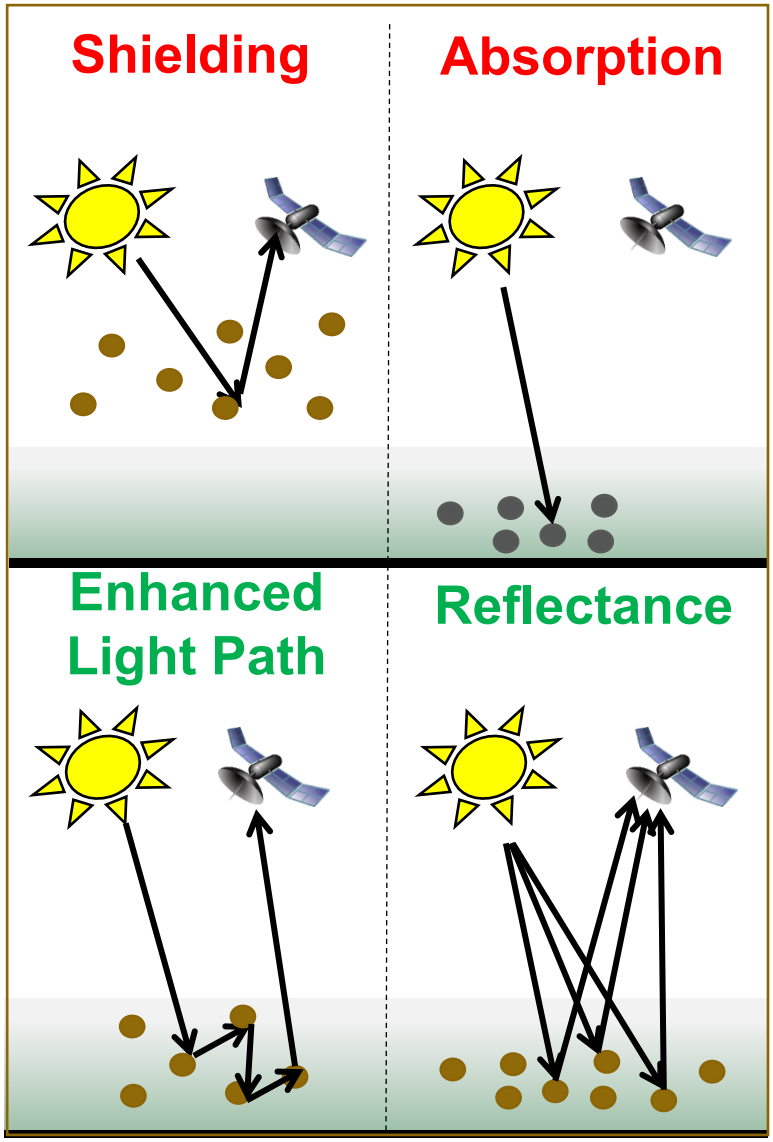
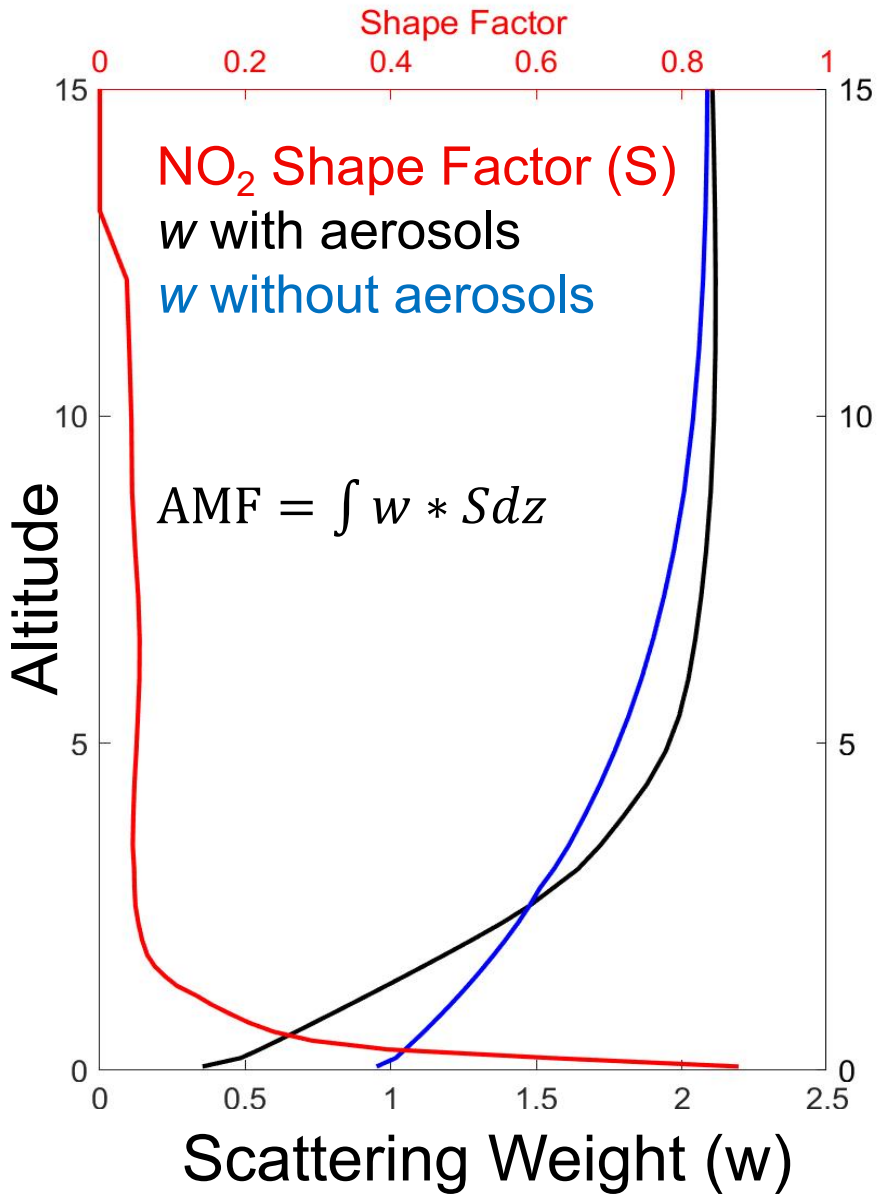
Aerosols affect satellite sensitivity to NO_2



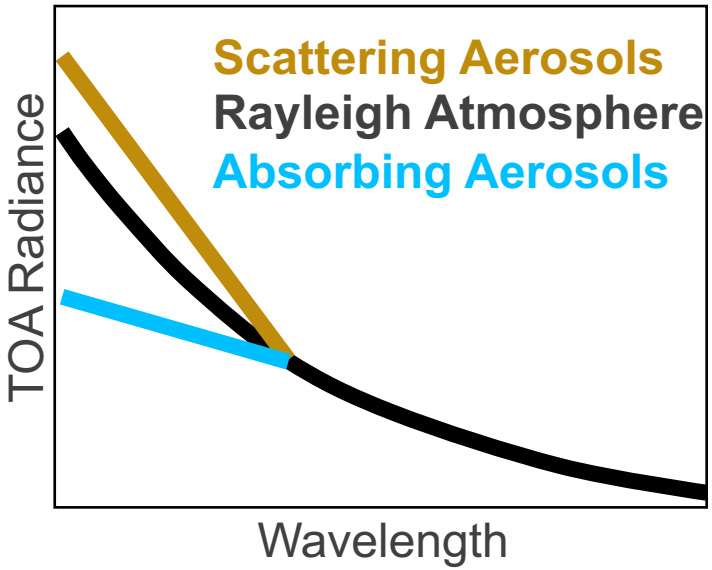
Lowers (Raises) AMF



An AAI – Aerosol Correction Relationship

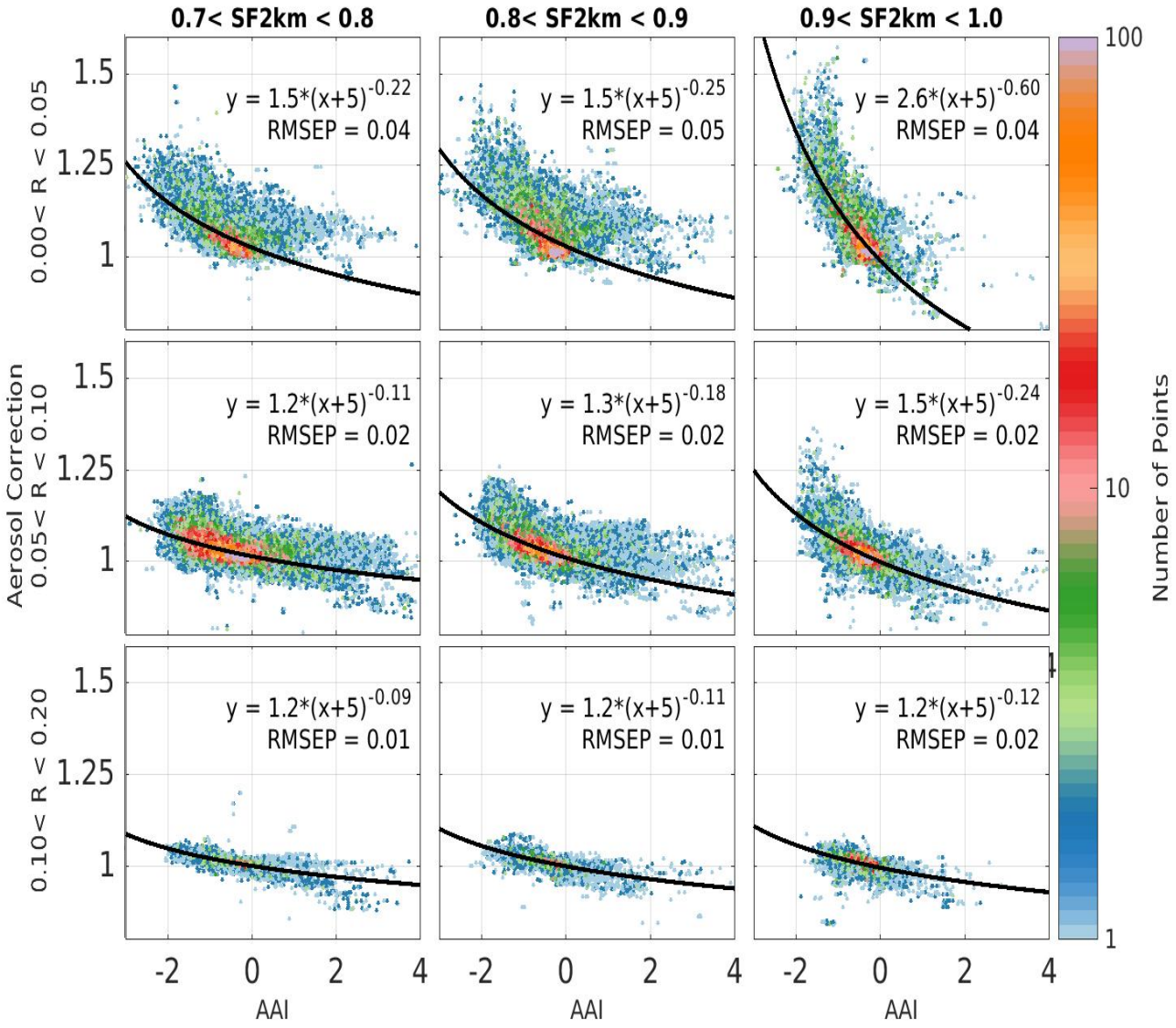
- Absorbing Aerosol Index
  - A **measurement** of aerosol absorption and scattering along light path
  - No *a priori* aerosol information

$$AAI = -100 \log_{10} \left[\frac{I^{observed}}{I^{Rayleigh}} \right]$$



- AAI can correct ozone retrievals (Torres & Bhartia 1999)
- Investigate for NO_2 using one year of synthetic OMI observations using GEOS-Chem
  - Only using cloud-free observations

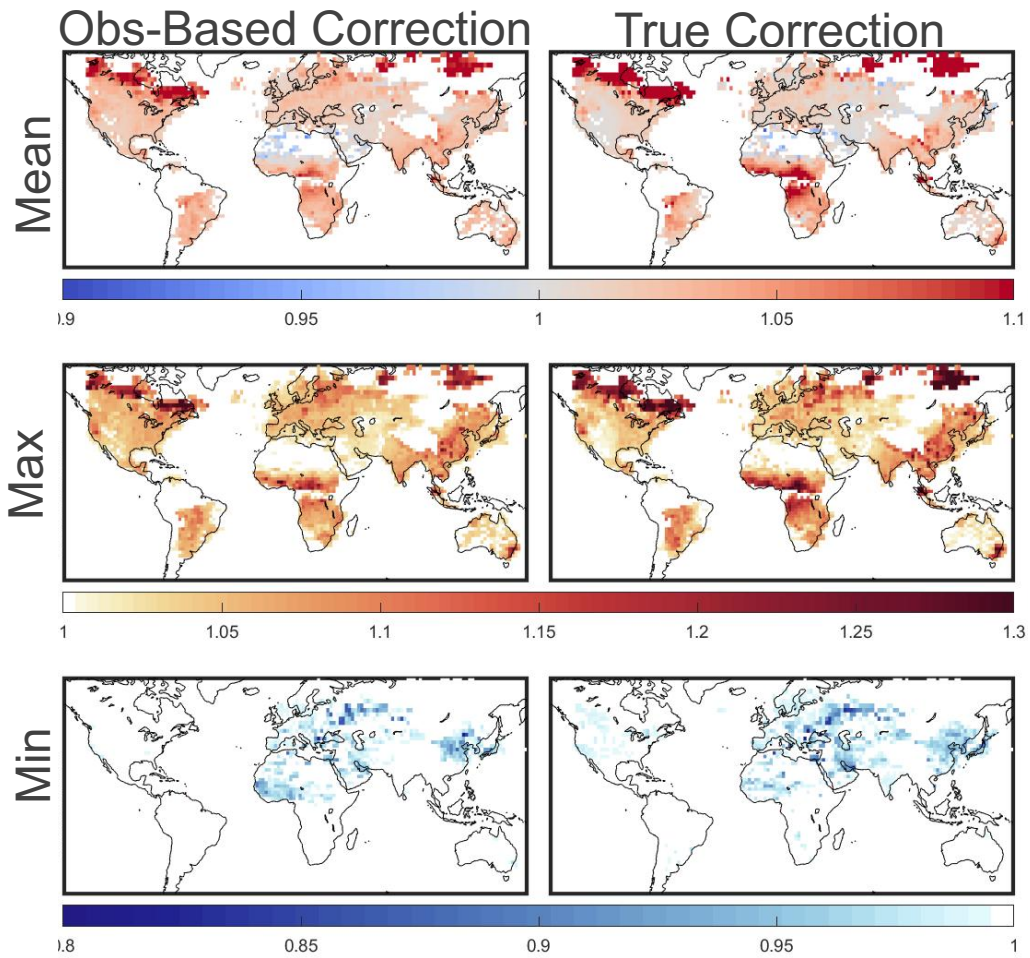
A Robust AAI-Aerosol Correction Relationship

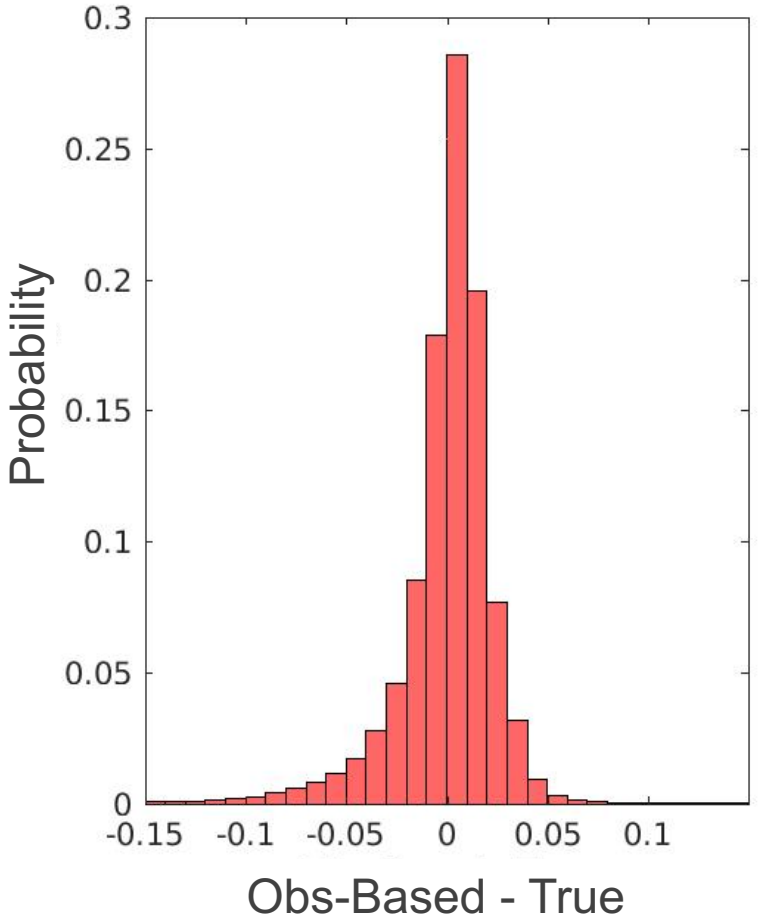


$$SF2km = \int_0^{2km} S(z)dz$$

$$Aerosol\ Correction = \frac{AMF_{with\ aerosols}}{AMF_{without\ aerosols}}$$

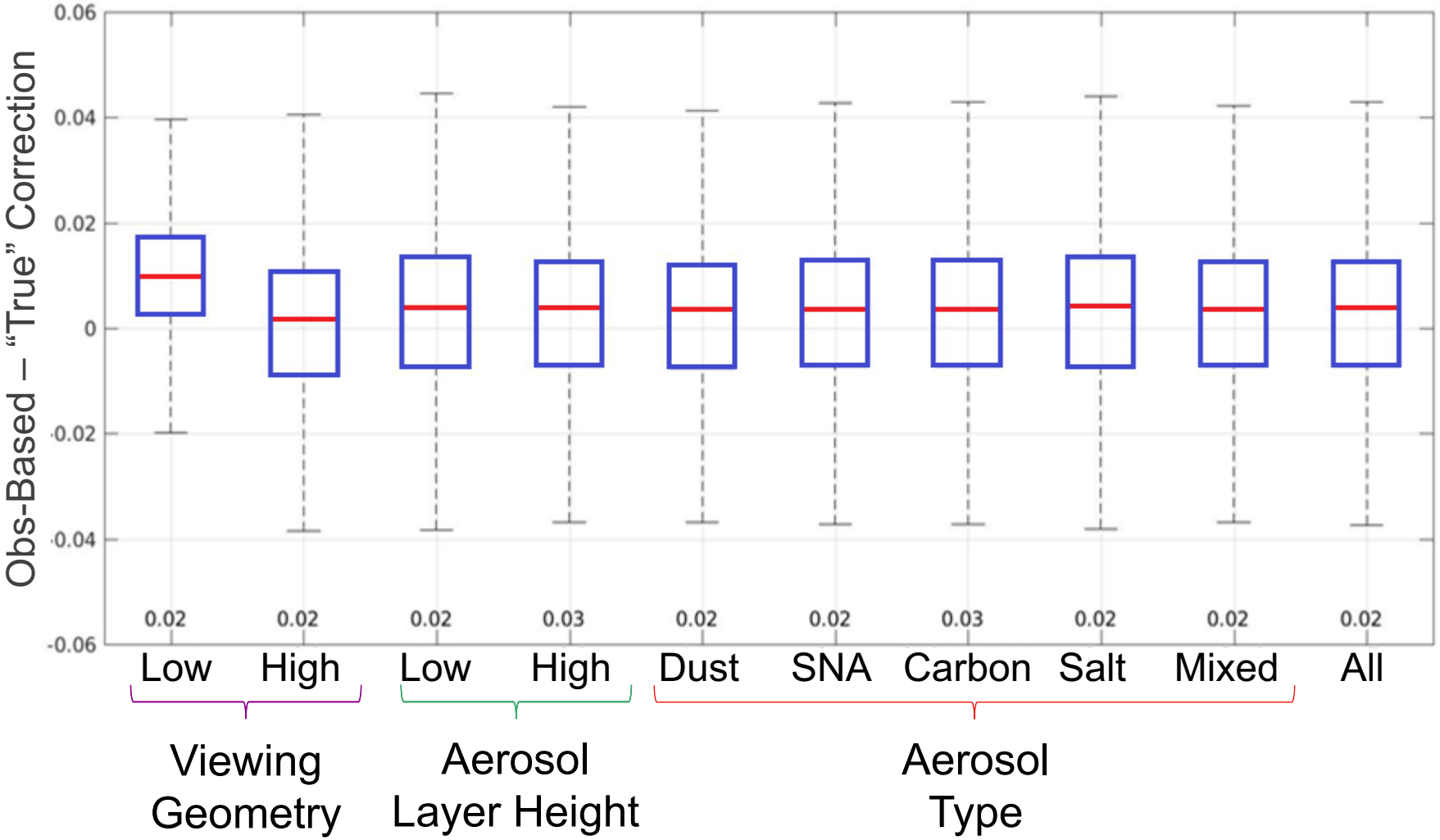
Evaluating the Obs-based Aerosol Correction





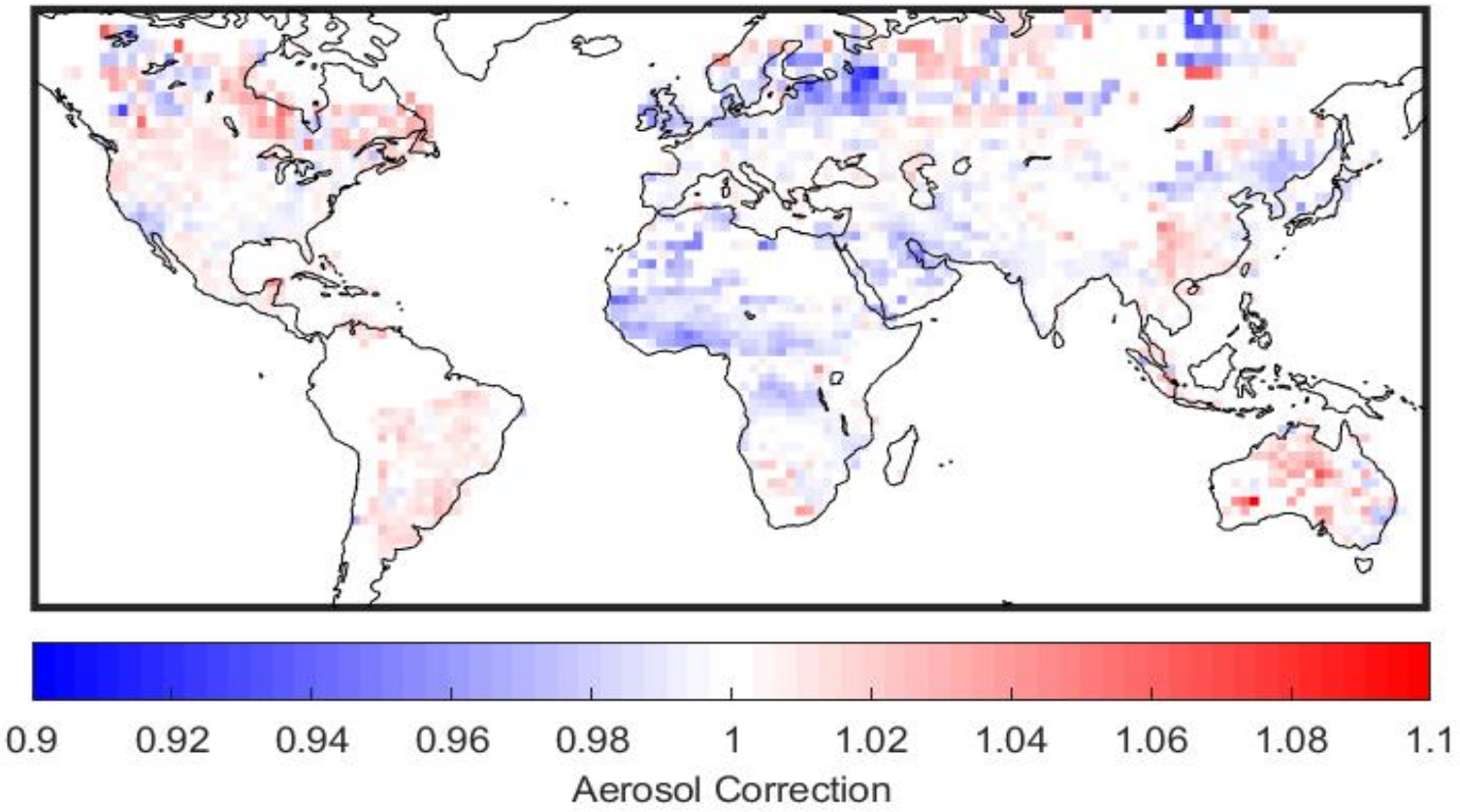
- Obs-based correction recreates the expected spatial distribution
- Obs-based correction within 5% of true correction 98% of cases
- Average error 0.9%

Potential Error Sources?



Obs-Based Correction works equally well for many aerosol types and conditions

Demonstrating with real OMI observations



- Use real OMI AAI values to estimate aerosol correction
- Observation-based correction reflects new information from observations

Advantages of an AAI-Based Correction

- Implicit aerosol correction does not account for AMF increases due to scattering aerosol (*Chimot et al.,* 2016)
  - AAI-based correction accounts for effects from both scattering and absorbing aerosol

- Explicit aerosol corrections rely on precision of modeled aerosol fields
  - AAI-AC model is insensitive to modeled aerosol errors

- AAI is a *measurement* that does not require any assumptions about aerosol type or distribution
  - And works well for most aerosol types and mixtures

An AAI-based correction is a promising method for estimating aerosol impacts on AMF from observations

Cooper et al., *Geophysical Research Letters,* 2019